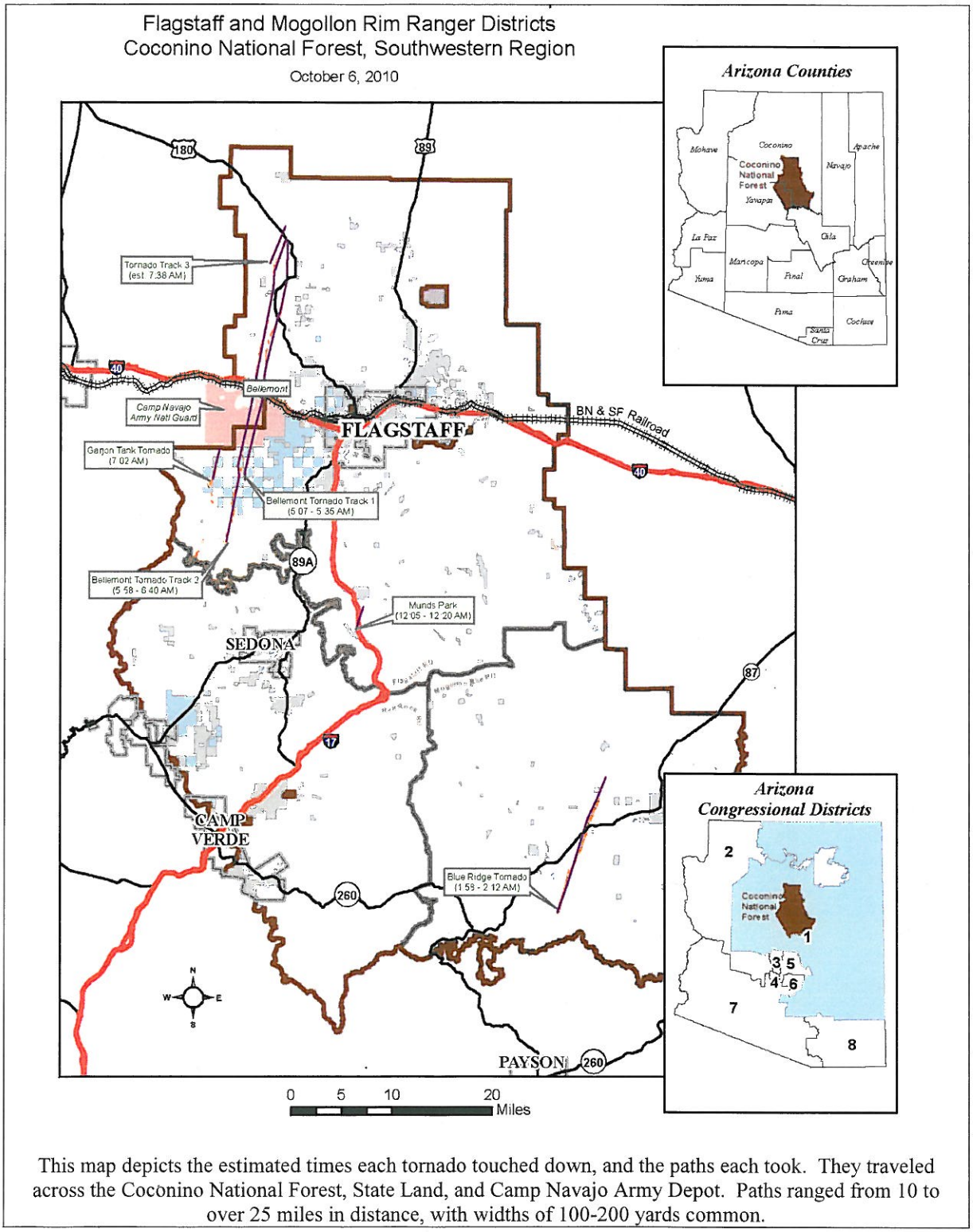
NAZ TORNADOS – Damage Assessment

16 Nov 2010

BACKGROUND: In the early morning hours of Oct 6th, a severe storm produced eight confirmed tornados resulting in considerable damage south and west of Flagstaff. One tornado was estimated at an F3, while the other seven ranged from an F1-F2 in intensity.



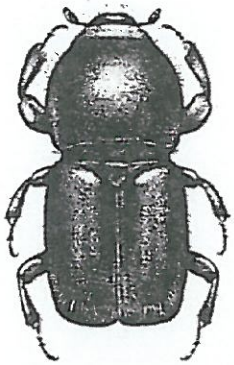
This map depicts the estimated times each tornado touched down, and the paths each took. They traveled across the Coconino National Forest, State Land, and Camp Navajo Army Depot. Paths ranged from 10 to over 25 miles in distance, with widths of 100-200 yards common.

The paths of Track 1 (right) and Track 2 (left) are clearly shown in this aerial photo. The picture was taken from the edge of Volunteer Canyon looking north toward Camp Navajo. Kendrick Mountain is in the center background.

Throughout the touch-down areas, damage occurred to critical wildlife habitat, water tanks/ponds, infrastructure (fence, power lines) and archeological sites. In addition, damage occurred to the Turkey Butte Lookout Tower, homes, businesses, and other structures at Camp Navajo and the Bellemont area, and a train was blown off the tracks at Camp Navajo.

But by far, the most prevalent damage, and the one of greatest concern, is to the forest. These photos depict the type of damage found throughout the areas. Trees within the direct path were either uprooted and blown down, or broken-off roughly 10-15 feet above the ground (area of greatest stress and flex on a tree).

The size of the trees was irrelevant to the damage incurred, ranging from the smallest to the largest found throughout the area. In addition, the scope is impressive: for example, in a two-hour period, Camp Navajo lost an estimated 6-7% of their total forest cover.



The Ips Bark Beetle, depicted here, will readily colonize the downed material and then move into standing damaged and stressed trees along the periphery of each path. This beetle, the size of a match-head, is what caused significant damage to our forests from 2003-2005

SCOPE OF DAMAGE: An estimated **6,500 acres** of timber were blown down: roughly 4,000 USFS, 1,500 Camp Navajo, and 1,000 State Land. An estimated **100,000+ cords** of wood are on the ground, ***but both the acreage and volume figures may be low.*** In addition to this visible damage, it is widely expected that additional trees on either side of each path, out to 50+ yards either side, will die in the near future from stress/twist damage incurred during the passage of each tornado. Bark Beetle populations will increase due to the overabundance of suitable breeding material, and could easily explode into very large and damaging numbers, leading to additional tree mortality over the next 2-4 years. The overwhelming majority of the affected area (current and potential) is southwest or west of Flagstaff, downwind and directly within the wildfire threat vector (approach path) of a major wildfire.

FACTORS INFLUENCING RECOVERY:

a) Funding – All three agencies are struggling with how to respond. Funding is being sought by each through their respective administrative channels to permit/speed timely harvesting and removal of wood and debris. An aggregate estimate for full clean-up on all ownerships is in the range of $4M. Securing the necessary funding for each is uncertain.
b) Capacity – Industry capacity to harvest and remove all the debris is not good: there are few vendors in the area capable of performing the needed work. (Due to the tangled mess of debris, some of the wood is under tension and improper removal could spring the trees thereby causing injury or death to unsuspecting and/or unqualified cutters. Heavy timber machinery, as opposed to typical timber machinery found in our area, is required; hand cutting this material would be a serious safety abuse.)
c) Utilization – The sheer volume of wood involved is well beyond current ability to absorb. To put the amount of wood into perspective, three comparisons are helpful: 1) we routinely give-away only 250 cords, already cut to length, during our fall free firewood days; 2) thinning treatments remove roughly 5-7 cords per acre, and 3) an average site in our area has 5-7 tons per acre of material on the forest floor, these sites now have upwards of 50+ tons per acre on the forest floor. The broken and splintered nature of much of the material and the soon-to-emerge presence of blue-stained fungus (introduced by Ips Beetles) will, in all likelihood, result in the wood having zero commercial value or use.
d) Weather - Winter and wet weather will quickly limit access and working conditions.

PROGNOSIS: Due to the factors identified above, clean-up and removal of all the material is ***not likely*** to occur, at least in the near future.

IMPACT: There are several aspects of this incident that will, or are likely to, impact the City. They include –

1) Wildfire – The material, unless cleaned-up, will represent a significant boost in the fire threat. Material that remains on-site will increase fire behavior in two ways: First, ignition and spread (including mid-long range spotting) will be "easy" as long as needles remain on the material (2+ years), and second, due to the amount of large material on the ground, intensity, and thus resistance-to-control, of any resulting fire will be high. This second component will remain in-place for the next several decades.
2) Smoke – Wildfires will produce smoke that is more-than-likely to be transported into town. But piling of material and burning, a likely outcome if clean-up funds can be found, will also produce tremendous amounts of smoke. (Piling and burning is the quickest method of disposal, and likely the most efficient due to the condition of the wood.) So, either way, smoke will be visible and present.
3) Aesthetics – The created openings themselves have introduced variety into the landscape and are not likely to draw undue attention. However, as the downed material/needles dry, or as standing trees adjacent to the paths die due to stress and/or bark beetles, the visual impact is likely to be striking.
4) Access – Although main forest roads have been cleared of debris, many secondary roads remain blocked. Travel off of many roads is not easy due to the "wall" of wood and debris stacked/lying alongside the right-of-way.
5) Forest Treatments – The scope of this incident – physical size, wood volume, and likely duration of response – have focused attention away from other projects and toward this issue. While one cannot argue with the logic of such an approach, funding targeted toward implementation-ready projects on State and National Forest parcels in-and immediately adjacent to the City, including monies which might become available in the near future, could easily be diverted toward this emergency. This redirection will likely slow-down or temporarily suspend these "ready" hazard fuel and forest restoration treatment projects for the next 1-3 years.

RESPONSE: We should -

1) Continue involvement with our partners, both in the planning and clean-up activities, assisting where possible;
2) Support their individual funding needs/requests to clean-up the areas;
3) Work with our partners to notify/educate the public as to the problem, recovery status, and potential;
4) Recognize that increased fire suppression engagement is likely in the area;
5) Focus a portion of our annual spring wildland fire refresher training on the potential/likelihood for increased fire behavior and the necessity for accurate size-up, deployment, and safety standards; and
6) Aggressively conduct controlled burn operations in the fire threat vector which:
   a) We own/manage → ex - city well field;
   b) We influence → ex: Arboretum, NAU Centennial Forest; and
   c) We have contract opportunities → ex: Naval Observatory, Camp Navajo